

THE DIFFERENCE OF THE FATIGUE PERCEPTION, EXERCISE PULSE RATE, AND BLOOD LACTIC LEVEL AFTER DOING MULTY STAGE FITNESS TEST AND YO-YO INTERMITTEND RECOVERY TEST

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Abstract

Physical capacity is the initial of sport development. To support the achievement of the purpose of the exercise, needed an instrument evaluation to determine whether there is progression that occurs during exercise program is running. Along with the development of science and technology, a variety of physical capacity assessment instrument to emerge following modification. Interest modifications and developments are based on some adjustments, including physical characteristics; the basic skills of the sport movement; and the specific energy system. Multi Stage Fitness Test and Yo-Yo Intermittent Recovery Test are two types of fitness test that often used to determine athlete's physical capacity, especially related to cardio-respiratory fitness. Although it has similar objectives, but at the time of execution, there are several differences. Objectives to be gained from this research are: knowing the difference in the achievement of the athlete's VO₂max; the perception of fatigue; determine the increase of exercise pulse rate; determine levels of blood lactate athletes after Multi stage fitness test and Yo-yo intermittent recovery test. The research design is quasi-experimental research, studies conducted with quantitative approach. Subjects consisted of 13 Basketball athletes. Determination of the study subjects by purposive sampling. The subject of research is basketball athletes who have followed an intensive training program for at least six months. Basketball men's team Senior High School 4 Yogyakarta already has many achievements as a junior athlete at the championship on regional and national level. The results showed: the characteristics of the subjects based on the mean age was 17 years, mean body weight 69 kilograms, and the average height of 175 cm. The result of the athlete's VO₂max using multistage fitness test lower than Yo-yo intermittent recovery test, the athlete's perception of fatigue multistage fitness test lower than Yo-yo intermittent recovery test. Increased exercise pulse rate athletes to Multi stage fitness test lower than Yo-yo intermittent recovery test. Increased levels of blood lactate athletes after a multistage fitness test lower than Yo-yo intermittent recovery test. Based on the description of the results, it can be concluded that the intensity of Yo-yo intermittent recovery test is higher, because psychologically athletes perceive (use: The Borg Rating of Perceived Exertion/RPE scale) this test is needed high exertion, and physically athletes increased exercise pulse rate and blood lactate higher than after do Multistage fitness test. But instead, the result of the athlete's VO₂max higher when measured by Yo-yo intermittent recovery test compared Multi stage fitness test.

Keywords: perception of fatigue, exercise pulse rate, blood lactate levels, multi stage fitness test, yo-yo intermittent recovery test.

1. Introduction

Physical capacity is the initial prestatif sports development and is the basis for a person if want to get involved in sport and obtain optimal results. To support the achievement of the goals of an exercise program. The necessary existence of an instrument evaluation to determine whether there is progression that occurs during exercise program was running, not least the biophysical capacity of athletes. The scope of practice together all the information from the sources of scientific and societal used

by trainers, along with his knowledge of the athlete in order to produce an effective exercise program. In the process of training required to practice various supporting knowledge that exercise can succeed as expected. The supporting knowledge of sports according Bomp (2000), among are: Anatomy, Physiology, Sports Medicine, Biomechanics, Statistics, Test And Measurement, Psychology, Motor Learning, Educational Science, Nutrition, History, And Sociology. All supporting science will be obtained in full in the lecture bench in college sports. Therefore, in the world of sports achievement training process that is done to

achieve it is a job that is very unique and full rehearsal, the actualization of each child's activity practice is strongly influenced by factors feelings, thoughts, emotions, and physical condition.

Many instruments have been developed, which aims to measure each component of the biophysical capacity of an athlete. Even in its development, modification of the instrument is not only based on physical components to be measured, but also consider the instrument test the sport what it will be used, adapted to the characteristics of motor skills and energy systems that run on certain sports.

Athletes not making machine medals, as individuals, athletes have a psychological component that can not be released. Therefore, it naturally follows that each person's actions must be the result of psychological component analysis, although then poured in a physical activity. Perception of fatigue is one of the psychological elements that can be measured. Psychologically this perception associated with thoughts, feelings, and emotions of athletes, or commonly referred to mental factors. Because one of the critical success factors of sports performance of an athlete is the mental readiness, of course, also be supported with physical readiness, techniques, and tactics. Mental readiness of an athlete associated with motivation, self-confidence, and emotions that can affect the performance and behavior of athletes, both during training and in matches. Many empirical studies that prove that the mental factor plays an important role (80%) in determining the athlete's performance (Lilik Sudarwati and Zainal Abidin, 2012).

Related to mental factors, then the athlete's perception of an instrument of measurement is also a thing to consider. Assuming that, if a person is perceptive considers a test in actual burdensome, then mentally will affect the internal motivation of athletes to carry out such tests, which ultimately will provide optimal results.

In the psychological aspect, perception of fatigue associated with thoughts, feelings, and athlete emotions, or commonly referred to mental factors. Readiness of an athlete's mental and behavior associated with motivation, self-confidence, and emotional. Many studies prove that mental factors play an important role in determining sport achievement. Athlete, is a complex individual who is not acting as a medal molding machine, beside the physical capacity factor, psychological component is also the most influence factor on the athlete's achievement. The perception of an athlete of the test

implementation, will Affect athletes seriousness and internal motivation in completing the test. Multistage fitness test or bleep test is a test performed on a flat pitch 20 meters. Testee required to run in accordance with the command from audio CD that starts at low speed and will grow slowly. Testee run from the starting line follow the cue and had to return to the starting line after hearing the continuation of the command from audio CD. Testee will keep running back and forth with the speed increases slowly until the Testee was unable to maintain his pace at a certain level. This level will indicate cardio-respiratory endurance, capacity of participants converted with $VO_2\text{max}$ tables. Yo-yo intermittent recovery test is a variation of the Multi stage fitness test. In its implementation using the same equipments with Multi stage fitness test, the different is Yo-yo intermittent recovery test had a time of active rest for 10 seconds. The rest, participants will continue to run follow audio CD command, such as the Multi stage fitness test.

Based on these assumptions, the researchers are interested in performing analysis related komparasional a measurement instrument that is often used by athletes to determine their physical capacities; multy stage fitness test and Yo-yo intermittent recovery test. Objectives to be gained from this research are: Knowing the achievement of $VO_2\text{max}$ measured using multy stage fitness test and Yo-yo intermittent recovery test; Knowing athletes fatigue perception against multy stage fitness test and Yo-yo intermittent recovery test; Knowing increased pulse rate occurring in athletes after multy stage fitness test and Yo-yo intermittent recovery test; and increased of blood lactate levels after multy stage fitness test and Yo-yo intermittent recovery test.

2. Method

This research was conducted using the method of test and measurement, conducted to see the differences in the level of some components related to the capacity of the athletes as measured using Multystage Fitness test and Yoyo Intermittent Recovery test. Data were presented descriptively. This research is descriptive percentages and methods used in this research is survey method with test and measurement techniques to retrieve data.

2.1 Subject

In order to achieve such a feat, then of course the athletes must have not only the

physical readiness, but also techniques and good psychic capacities. Subject of the study were selected based on purposive sampling method intended to minimize the data bias, assuming heterogeneity can be controlled. Based on some of considerations the subject of this research are basketball athletes that had been engaged with at least six month training programe, in additionally was compete in nasional level. This research was involving 13 basketball junior athletes of Senior High School 4 Yogyakarta that can be assumed that the biophysical capacities are able to perform physical tests, which are given for research data collection process. It is conducted in UNY outdoor basketball court.

2.2 Measurement Procedures

The study is divided into two stages of implementing: the first stage done multistage fitness test, the second stage Yo-yo intermittent recovery test. Data collected by the implementation stages as follows: (1) Subjects were given an explanation of the purpose, objectives, and benefits of research (2) The research subjects fill out a form of basic data, and signed a statement of willingness to engage in research (3) Subject performed two data retrieval research done on different days. On the day of data collection, the subjects follow the research procedure; at first Subject briefed execution of tests, than Subject pre-test pulse rate calculated, before doing the test. After that, their initial blood lactate levels calculated, and Subjects doing the test (Multistage Fitness test and Yoyo Intermittent Recovery test in the different day). Subsequently, Subject post-test pulse rate is calculated, Subject measured blood lactate levels after the test, and finally Subject fill fatigue assessment instrument perceptin (RPE).

2.3 Multistage Fitness Test

The athlete's maximum oxygen uptake (VO_2 max) can be determined from the MSF-Table using the Level and Shuttle achieved. The objective of the Multi-Stage Fitness Test (MFT), developed by Leger & Lambert (1982), is to monitor the development of the athlete's maximum oxygen uptake (VO_2 max). This test is very good for games players such as Basketball and soccer. Test reliability will depend upon how strict the test is conducted and the individual's level of motivation to perform the test. This test provides a means to monitor the effect of training on the athlete's physical development. There are published VO_2 max score equivalents for each level reached and the correlation to actual VO_2 max is high. For an assessment of your VO_2 max

to see the VO_2 max normative data tables is needed (Mackenzie, B. 1999).

2.4 Yoyo Intermittent Recovery Test

This test was developed by the Danish soccer physiologist Jens Bangsbo. Essentially repeated 40m (2x20m) runs with a recover period in-between. The Yo-Yo Intermittent Tests are similar to the commonly known Beep Test. However, in the intermittent tests the participants have a short active break (5 and 10 seconds for the intermittent endurance and intermittent recovery test, respectively). The objective of the "Yo-Yo Intermittent Recovery Test" is to monitor the development of the athlete's maximum oxygen uptake (VO_2 Max) and ability to perform repeated interval work. Reliability will depend upon how strict the test is conducted and the individual's level of motivation to perform the test. This test provides a means to monitor the effect of training on the athlete's physical development (Jens Bangsbo, 2005).

3. Result

Characteristics of Respondents Data results showed, has a specific research subjects were described as characteristics of respondents in general. Characteristics of respondents described in the following table:

Table 1. Characteristics of Subject

Variable	Min value	Maks value	Average
Age	16 tahun	18 tahun	17 tahun
Weight	51 Kg	95 Kg	69 Kg
Height	162 Cm	186 Cm	175 Cm
BMI	18	31	22.5

Based on the table overview of the subject of research by the mean age was 17 years, mean body weight 69 Kilograms, and the average height of 175 Cm. Subjects body mass index average is within normal.

3.1 Cardiovascular Endurance (VO_2 Max)

Data obtained from multistage fitness test is a data level and the shuttle which is then converted to the table predictive value that has been validated and adopted, while the yo-yointermittend recovery test data obtained is the total distance participants calculated using the formula of VO_2 max from Bangsbo, et al. (2008). Data VO_2 max of each test are then categorized using tables VO_2 max of Heywood (1998). The results of the study cardiovascular endurance levels or VO_2 max using multistage fitness test and yo-yo intermittent recovery test subjects are as follows.

Cardiovascular endurance ($VO_2\max$) based on the cardiovascular endurance test methods multistage fitness test and yo-yo intermittent recovery test. Cardiovascular endurance levels of

the test method or $VO_2\max$ multistage fitness test and Yo-yo intermittent recovery test are presented in the following table.

Table 2. Cardiovascular endurance ($VO_2\max$) based on the method of multistage fitness test and Yo-yo intermittent recovery test

No	Category	Test-method			
		MFT	%	Yo-yo	%
1.	Very low	0	0	0	0
2.	Low	2	15,4	0	0
3.	moderate	5	38,4	5	38,4
4.	Good	5	38,4	7	53,8
5.	Very good	1	7,7	1	7,7
6.	High	0	0	0	0
Jumlah		13	100	13	100

According to the table or the cardiovascular endurance $VO_2\max$ above can be illustrated with the following bar chart.

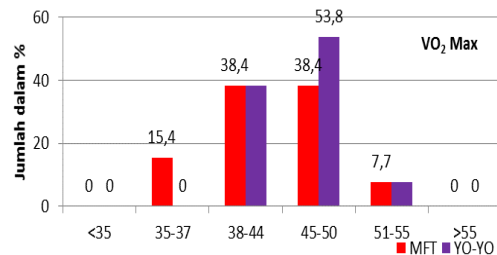


Figure 1. The bar chart cardiovascular endurance ($VO_2\max$) athletes based on the method MFT and Yo-yo test

3.2 Fatigue Perception Index (Rating of Perceived exertion/RPE)

Index fatigue in this study was conducted using the fatigue scale rating of perceived exertion (RPE), which is used by the Borg. Scale used starting from 6 scale (do not feel tired at all) to a scale of 20 (very, very heavy unbearable). Participants test measures the fatigue index of the two tests by selecting the appropriate scale with the perception of fatigue felt by the participants. Athlete fatigue perception index of the cardiovascular endurance test using multistage fitness test and yo-yo intermittent recovery test are presented in the following table (Borg, GA., 1982).

Table 3. Fatigue index (RPE) athletes to the method of multistage fitness test and yo-yo intermittent recovery test

No.	Skale RPE	Fatigue description	Test Methode			
			MFT	%	Yo-yo	%
1.	6	No exertion at all	-	-	-	-
2.	7	Extremely light	-	-	-	-
3.	8		-	-	-	-
4.	9	Very light	-	-	-	-
5.	10		-	-	-	-
6.	11	Light	1	7,7	-	-
7.	12		-	-	-	-
8.	13	Somewhere hard	4	30,8	5	38,5
9.	14		-	-	-	-
10.	15	Hard (heavy)	7	53,8	7	53,8
11.	16		-	-	-	-
12.	17	Very hard	1	7,7	1	7,7
13.	18		-	-	-	-
14.	19	Extremely hard	-	-	-	-
15.	20	Maximal exertion	-	-	-	-
total			13	100	13	100

Based on the index table fatigue (RPE) above can be illustrated with the following bar chart.

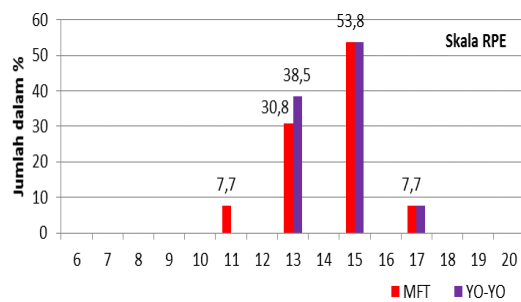


Figure 2. The bar chart fatigue index multistage fitness test methods and yo-yo intermittent recovery test

3.3 Pulse Exercise

Based on the research results, data showed normal pulse rate and pulse rate athletes workout while doing multistage fitness test and yo-yo intermittent recovery test.

Table 4. Difference pulse after a multistage fitness test and yo-yo intermittent recovery test

Value	Test Method	
	MFT	Yo-yo
Min	36	56
Max	100	117
Mean	62.92308	81.08333
Average %	62.15385	94.23077

The table shows the differences in the difference increased pulse rate athletes while doing multistage fitness test and yo-yo intermittent recovery test. It appears that the average value increased pulse rate in athletes while doing multistage fitness test lower (62.92) than the yo-yo intermittent recovery test (81.08). Meanwhile, when viewed from the percentage of the multistage fitness test only provides increased pulse rate amounted to 62.15%, while the yo-yo intermittent recovery test provides increased pulse rate of 94.23%.

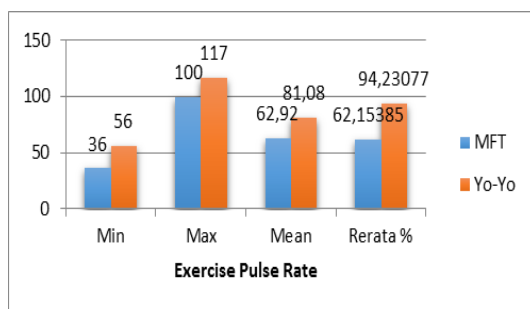


Figure 3. The spread differential increased pulse rate exercise on a multistage fitness test and yo-yo intermittent recovery test

3.4 Blood Lactate Levels

Lactate is a substance that produced by one's metabolic processes, an increase in lactate levels can be caused by several things. For instance, it produced when anaerobic heavy physical activity occur or when the body is in certain health conditions. Multistage fitness test and yo-yo intermittent recovery test is basically a method used to determine a person's aerobic endurance. But the governance phase of combustion energy in the body, going through anaerobic phase first before running the aerobic phase. Therefore, someone who does multistage fitness test and yo-yo intermittent recovery test also produces lactate. the blood lactate concentration difference between the multistage fitness test and yo-yo intermittent recovery test presented below.

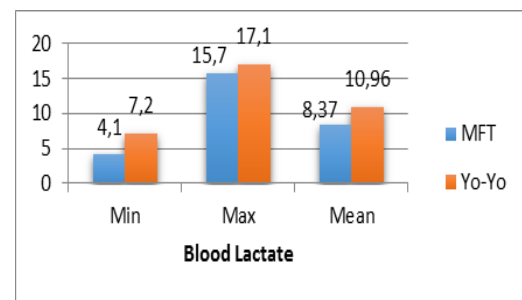


Figure 4. Differences in blood lactate levels after a multistage fitness test and yo-yo intermittent recovery test

4. Discussion

Cardiovascular endurance (VO_{2max}) is a major factor in the game of basketball. Basketball game requires players to play with intermitant explosive so need the encouragement of the cardiovascular endurance is good. Basketball game made for 10 minutes in 4 quarters, so claim the players to play very quickly to produce the scors. In his Introduction to the 'Theory and Methodology of Physical Training', Sukadiyanto (2011) states, The relationship between resistance and performance (appearance) Physical sportsman whom are added: (1) the ability to perform activities of working continuously with high intensity and in the long term, (2) ability to memperdek recovery time (recovery), especially in sport competitions and games, (3) the ability to receive training burden heavier, longer, and vary. Thus sportsman who has good resistance will benefit during the match, including sportsmen will be able to: (a) determine the rhythm and pattern of

the game, (b) maintaining or changing the rhythm and pattern of the game as expected, and (c) to fight for ductile and do not give up during the contest.

Yo-yo intermittent recovery test is a test of endurance developed pulmonary heart of the multistage fitness test in 2008 by Bangsbo so that such tests are not widely known by athletes. Knowledge athletes less against the test affect a person's perception accordingly as described by David Krech cited by Diesty Eka Kurnia Wati (2009), stating a person's perception is influenced by: Frame of Reference, which is a framework of knowledge that is owned and influenced from education, reading, research, and Frame of experience, that experience he had experienced that can not be separated from the state of the surrounding environment.

Based on the results of the data level of durability heart lung that has been described can be seen level of durability heart lung or $VO_2\text{max}$ athlete of the multistage fitness test lower than the yo-yo intermittent recovery test because the level of endurance heart lung or $VO_2\text{max}$ athlete of the yo-yo intermittent recovery test no one is in the category of low and very low.

Yo-yo intermittent recovery test has an active recovery that is not owned by multistage fitness test. Yo-yo intermittent recovery test according to the type of exercise performed at a basketball game that has an active recovery between games are explosive. Type the same exercise with the yo-yo intermittent recovery test affects the cardiovascular endurance levels correspond to that described by Brian J. Sharkey (2003: 80), factors exercise can enhance the function and capacity of the respiratory system, cardiovascular and blood volume, but changes the most important occurs in muscle fibers that are used in practice. Muscle fibers undergo these changes make it easier for the athletes perform cardiovascular endurance test by the method of yo-yo intermittent recovery test sehingga get a higher level of $VO_2\text{max}$.

Science and technology will always experience growth for refined and certainly to facilitate human in doing the job. Tests and measurements of cardiovascular endurance is also experiencing growth as the multistage fitness test and yo-yo intermittent recovery test. Yo-yo intermittent recovery test is carried out at intermittent sports such as basketball suite is described by Lilik and Zainal (2012: 27-28), cardiovascular endurance test Aerobic exercise should use the same type carried out by participants with a general time of about 8 -15 minutes, if shorter and increase the anaerobic energy then this test will be less valid.

Perception mental fatigue will affect the ability of the athlete on the pitch and counter the perception of fatigue is felt on the pitch. Various sports psychology article said "80% of the athletes victory is determined by the mental factor". That is the mental factor plays a very important in determining achievement of an athlete (Lilik Sudarwati and Zainal Abidin, 2012: 4-5) Athletes who have good mental will be able to fight during the game, on the contrary if the athlete has a mental low will not be able to survive against fatigue is felt on the pitch.

Based on research data of fatigue perception index that has been described above, it can be seen athletes fatigue perception index of the multistage fitness test method is lower than the method of yo-yo intermittent recovery test. However, athletes cardiovascular endurance achievement used yo-yo intermittent recovery test higher than the multistage fitness test.

Athlete fatigue perception index which is measured by RPE scale of Borg is within a scale of 11 (mild) totaled 1 (7.7%), a scale of 13, amounting to 4 people (30.8%), a scale of 15 amounted to 7 people (53.8%), a scale of 17 numbered 1 (7.7%). The scale shows the perception of fatigue endurance athletes to test heart lung using multistage fitness test. Athlete fatigue perception index of the cardiovascular endurance test using yo-yo intermittent recovery test is in the scale of 13 (moderate) of 5 people (38.5%), a scale of 15 amounted to 7 people (53.8%), totaling 17 scale 1 (7.7%). Based on the results of these data can be seen on the perception of fatigue athletes multistage fitness test lower than the yo-yo intermittent recovery test due to the perception of fatigue athletes to yo-yo intermittent recovery test does not exist that is on a scale of 11 (mild).

Based on the results of these data it can be seen that the increase in lactate levels in the blood of athletes after conducting test methods multistage fitness test lower than the yo-yo intermittent recovery test, which means it can be assumed that the intensity of physical activity undertaken during the test yo-yo intermittent recovery test higher, so that the athletes increased blood lactate more than after a multistage fitness test. All exercise draws first on intramuscular stores of ATP and creatine phosphate; initially these are replenished by anaerobic glycolysis. The lactic acid produced contributes to the rapid development of fatigue in high intensity exercise. Aerobic metabolism (at first mainly of glycogen, later increasingly of fat) is the principal route of ATP resynthesis in activities lasting longer than 2 min, but can only maintain work-rates about

1/4 of those possible in very brief bursts (Spurway NC. 1992; Guyton, 2006).

Robergs and others showed that this common understanding has some flaws. It turns out that anaerobic respiration functions all the time, turning sugar into a compound called pyruvate, releasing some hydrogen ions at the same time. Aerobic respiration works to clean up the pyruvate, using oxygen to burn the pyruvate into carbon dioxide and water, which can be exhaled. The aerobic process also consumes acid (hydrogen ions), which retards the buildup of acid in the muscles (Robergs, R. A 2004).

The generation of lactate is actually a side reaction: when excess pyruvate and acid start to accumulate (when the rate of anaerobic respiration overtakes the aerobic system's ability to remove the waste), the body uses a pyruvate molecule and a hydrogen ion to create lactate, another way in which it can slow down the buildup of acid. The lactate can also be shuttled out of the muscles, into the blood, and burned in other areas of the body for more energy (Jeff, NY).

Heart rate (HR) monitoring is the most popular indirect method of estimating intensity of exercise and it also seems to be the most practical and low-cost method. Previous studies have not generally found differences in terms of HRmax measured during the Yo-Yo test and in different treadmill, also found no significant differences in HRmax values between the Yo-Yo continuous and intermittent tests as well as maximal exercise treadmill test with continuous and intermittent protocols (Baris Karakoc, 2012). The pulse is one of the main indicators that describe the person's physiological performance, the heavier the intensity of physical work done will be directly proportional to the increase in pulse rate. Based on these data it can be seen that the increase in pulse rate training athletes to test methods of multistage fitness test lower than the yo-yo intermittent recovery test, which means it can be assumed that the intensity of physical activity undertaken during the test yo-yo intermittent recovery test is higher than the multistage fitness test.

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